Research Article • DOI: 10.2478/law-2026-0002 LAW • 6 • 2026 • 1–14



Law and Business

Sustainability under scrutiny: From corporate greenwashing to environmental verifiability

María Concepción Rayón Ballesteros[1], José Luis González Ávila[2], María Marelza Cózar Martínez[3]

[1]Professor of Law at the Complutense University of Madrid, Registered Mediator at the Ministry of Justice, Doctor of Law and Graduate in Political Sciences and Public Administration; [2]Professor in the Department of Computer Science at the University of La Laguna, Civil Servant of the Autonomous Community Government of the Canary Islands, Project, Manager for the Administrative Procedures Processing Platform, Tutor in Industrial Engineering at the National University of Distance Education (UNED); [3]Professor of Law at Centro de Estudios Garrigues, Madrid Lawyer and Compliance Officer

Abstract

The growing importance of sustainability in corporate strategy has placed companies' environmental statements under a new legal paradigm: it is no longer sufficient to communicate green commitments; they must be proved in a clear, objective, verifiable and legally defensible manner. This article analyses the development of greenwashing from a practice mainly associated with misleading advertising into a structural problem of transparency, regulatory compliance and environmental evidence. To that end, it examines, first, the European and Spanish regulatory framework applicable to environmental claims, with particular regard to the prohibition of generic, vague or unsubstantiated statements, as well as the new requirements for reliable information on corporate sustainability. Secondly, it studies the internal implications for companies, which will have to strengthen their governance systems, coordinate their legal, marketing and sustainability areas, build robust evidential files and anticipate potential litigation or sanctioning proceedings for misleading environmental advertising. Finally, the article addresses the role of verification technologies — satellite observation, artificial intelligence, blockchain, natural language processing and digital auditing — as tools capable of preventing, detecting and evidencing greenwashing practices. The central thesis is that corporate sustainability is entering a phase of reinforced verifiability, in which environmental credibility will depend on organisations' ability to transform their commitments into traceable data, documented evidence and legally robust controls.

Keywords

greenwashing • corporate sustainability • environmental transparency • regulatory compliance • misleading advertising • environmental evidence • artificial intelligence • blockchain • technological verification

Introduction

European law has placed corporate sustainability in a field that is no longer merely technical, but is now far more evidential. For years, the market tolerated expressions such as "green", "eco", "natural" or "climate-neutral" as signs of reputation, often detached from any sufficiently technical explanation. That cycle is coming to an end. The legally relevant question is no longer whether a company wishes to present itself as sustainable, but whether it can demonstrate, before communicating, that the environmental statement it makes is accurate, intelligible, proportionate, non-omissive and documentarily verifiable.

Greenwashing is not exhausted by direct falsehood. Its most problematic forms arise in intermediate areas: exaggerating real benefits, selecting favourable data, using private labels with an official appearance, attributing a partial improvement to the product as a whole, converting future objectives into present results, or replacing effective emission reductions with narratives of offsetting. This is why Spanish legal scholarship has situated the phenomenon at the intersection of unfair competition, consumer protection, pre-contractual information, corporate responsibility and the ecological transition.

The dogmatic consequence is clear: the environmental statement becomes a unit of legal risk. Each claim contains a promise addressed to the market and generates a corresponding burden of explanation. If the message leads the average consumer to attribute to the product, service or trader an ecological advantage greater than the real one, sustainable discourse ceases to be legitimate communication and may become a misleading practice.

It is precisely these issues that this article addresses, distinguishing three clearly differentiated parts. First, we shall analyse the European and Spanish regulatory framework applicable to environmental claims, especially in relation to generic, vague or evidentially unsupported statements. Secondly, we shall examine the internal consequences for companies, which are required to reinforce their governance, coordinate their departments and prepare robust evidential files in anticipation of potential litigation or sanctions. Finally, we shall study the role of verification technologies — such as artificial intelligence,

† Corresponding author: María Concepción Rayón Ballesteros
E-mail: mariaconcepcionrayon@gmail.com, mcrayon@ucm.es

Open Access. © 2026 Author(s).
This work is licensed under the Creative Commons Attribution-NonCommercial-NoDerivs 4.0 License.

blockchain, satellite observation and digital auditing — in the prevention and proof of greenwashing. The central idea is that corporate sustainability is entering a phase of reinforced verifiability, in which only environmental commitments supported by traceable data, documented evidence and legally robust controls will be credible.

Regulatory framework for environmental transparency and sustainability statements

The expansion of greenwashing is explained by the economic value that sustainability now represents. In saturated markets, the environmental attribute differentiates, legitimises and guides the decisions of consumers who are increasingly sensitive to the ecological transition. The problem arises when the semantic density of the message is far lower than its legal density: more is promised than the company's evidential infrastructure is capable of supporting.

The European Commission warned that a significant proportion of the environmental claims examined in the Union provided vague, misleading or unfounded information, and that many lacked sufficient evidential support.[1] That diagnosis justifies the tightening of regulation: if the ecological market depends on trust, trust cannot rest on unverifiable self-declarations.

In this respect, three different levels should be distinguished in approaching the matter. The first is falsehood: an objectively incorrect statement, such as declaring recycled content that does not exist. The second is ambiguity: an imprecise expression that creates an excessive environmental impression. The third is omission: a partially true statement that withholds information necessary to assess the real impact of the offer. In all three cases, what matters is not only the literal truth of each sentence, but the overall effect of the commercial presentation on the average consumer.

1. Directive (EU) 2024/825: the normative core of the new anti-greenwashing discipline

Directive (EU) 2024/825 constitutes the positive-law axis of the new European framework against greenwashing. It amends Directive 2005/29/EC on unfair commercial practices and Directive 2011/83/EU on consumer rights, in order expressly to include environmental, social and circularity characteristics among the elements capable of misleading consumers.[2] In doing so, the European legislature ceases to treat the environmental dimension as an advertising adornment and regards it as a principal characteristic of the product or of the business activity.

The legislative technique is twofold. On the one hand, it integrates environmental claims into the general assessment of deception: a communication will be unlawful if it contains false information or if, despite being formally correct, it may cause the average consumer to take a decision that he or she would not otherwise have taken. On the other hand, it expands the blacklist of practices that are in all circumstances unfair, thereby removing from the market conduct that is particularly corrosive of environmental trust.

The first category affected is that of generic environmental claims. Expressions such as "eco", "green", "sustainable" or "planet-friendly" cease to be advertising catch-all terms: they may be used only where there is, in fact, excellent environmental performance that is recognised and relevant to the statement made. The broader the claim, the heavier the burden of justification.

The second category is the undue extension of the claim. The Directive prevents the entirety of a product, a company or an activity from being presented as sustainable where the improvement concerns only one specific aspect. The part cannot absorb the whole. A marginal product line, a pilot project or a partial logistical improvement does not authorise a globally sustainable corporate image.

The third category concerns climate neutrality based on offsets. The rule prohibits the assertion, on the basis of greenhouse gas offsetting, that a product has a neutral, reduced or positive impact in terms of emissions.[3] Offsetting may be a complementary tool, but it must not be presented as eliminating climate impact. In addition, the Directive requires future commitments to be supported by clear, public and verifiable plans, endowed with resources and subject to monitoring.

2. The proposed Green Claims Directive: scientific substantiation as a regulatory horizon

The proposal for a Directive on explicit environmental claims, known as the Green Claims Directive, sought to complete the system through a more technical standard of substantiation, communication and verification. Its core was straightforward:

1 European Commission. "Consumer Protection: Enabling Sustainable Choices and Ending Greenwashing." Press release IP/23/1692, 22 March 2023. https://ec.europa.eu/commission/presscorner/detail/en/ip_23_1692.

2 European Parliament and Council of the European Union. Directive (EU) 2024/825 of the European Parliament and of the Council of 28 February 2024 amending Directives 2005/29/EC and 2011/83/EU as regards empowering consumers for the green transition through better protection against unfair practices and through better information. OJ L, 2024/825, 6 March 2024. https://www.boe.es/buscar/doc.php?id=DOUE-L-2024-80326.

3 European Parliament and Council of the European Union, Directive (EU) 2024/825, Annex I.

voluntary environmental claims addressed to consumers had to be based on robust, scientific and verifiable methods; specify whether they referred to the whole product, to part of it, to a stage of its life cycle or to a business activity; and, in certain cases, be subject to review by an accredited independent verifier.[4]

Nevertheless, this proposal should not be presented as fully applicable law in force. Following the legislative progress made in 2024, the Commission announced in June 2025 its intention to withdraw it, the third trilogue scheduled was cancelled, and the European Parliament maintains it in an uncertain situation, although it still appears as a pending proposal in the institutional programming.[5] The point is essential: Directive 2024/825 constitutes the legal floor currently in force; the Green Claims Directive now operates as a regulatory horizon, an interpretative source of trends and a warning as to the future substantiation of claims. Even in that state, the proposal retains dogmatic value that should be taken into account. It expresses an idea that will probably endure: an environmental statement requires a recognisable methodology. It must be possible to know what impact is being measured, by reference to what benchmark, over what period, within what limits and subject to what uncertainties. Recent scholarship has seen in this development the move from ex post repression of misleading advertising towards a preventive logic of reliable environmental information.

3. Corporate transparency through the conversion of reporting into evidential infrastructure

The regulation of environmental claims cannot be separated from the new European regime on corporate sustainability reporting. Directive (EU) 2022/2464, of the European Parliament and of the Council of 14 December 2022 amending Regulation (EU) No 537/2014, Directive 2004/109/EC, Directive 2006/43/EC and Directive 2013/34/EU, as regards corporate sustainability reporting (Corporate Sustainability Reporting Directive, CSRD), raises sustainability information to a category close to financial information: comparable and verifiable data, subject to European standards and intended for investors, consumers, workers, authorities and civil society.[6]

The practical consequence is decisive for the issues addressed in this article: the sustainability report and commercial advertising cannot operate as watertight compartments. If the reporting acknowledges uncertainties, methodological limits, significant emissions or dependence on transition plans that have not yet been implemented, the advertising campaign cannot project a closed, triumphalist or absolute environmental image. Consistency between reporting, marketing and institutional communication becomes a requirement of informational integrity.

Furthermore, verification of sustainability information reinforces the move towards evidence. In Spain, the Institute of Accounting and Auditing (ICAC) has emphasised that the CSRD requires verification by the statutory auditor or, where appropriate, by another accredited independent auditor or provider.[7] ESG data, as non-financial information measuring a company's performance and impact in three key areas (Environmental, Social and Corporate Governance), ceases to be pure self-description: when a company communicates an environmental advantage, that advantage must be capable of being connected back to reported data, calculation methodologies, internal controls, documentary traceability and external verification.[8]

Accordingly, the company must report both on how sustainability matters affect its financial position and on how its activities affect people and the environment. This prevents selective communication focused only on reputational opportunities and requires the environmental impact of the business model to be integrated into the assessment of the claim.

4. Due diligence, value chain and deforestation-free products

Directive (EU) 2024/1760 of the European Parliament and of the Council of 13 June 2024 on corporate sustainability due diligence and amending Directive (EU) 2019/1937 and Regulation (EU) 2023/2859 (Corporate Sustainability Due Diligence Directive, CSDDD) completes the picture by projecting obligations onto actual or potential adverse impacts on human rights and

4 European Commission. Proposal for a Directive of the European Parliament and of the Council on Substantiation and Communication of Explicit Environmental Claims (Green Claims Directive). COM(2023) 166 final, 22 March 2023. https://environment.ec.europa.eu/publications/proposal-directive-substantiation-and-communication-explicit-environmental-claims_en.

5 European Commission, Proposal for a Green Claims Directive, COM(2023) 166 final.

6 European Parliament and Council of the European Union. Directive (EU) 2022/2464 of the European Parliament and of the Council of 14 December 2022 amending Regulation (EU) No 537/2014, Directive 2004/109/EC, Directive 2006/43/EC and Directive 2013/34/EU, as regards corporate sustainability reporting. OJ L 322, 16 December 2022, 15-80. https://www.boe.es/buscar/doc.php?id=DOUE-L-2022-81871.

7 The ICAC (Institute of Accounting and Auditing) is an autonomous body of the Ministry of Economy, Trade and Enterprise of Spain. It is the public institution responsible for regulating accounting, supervising and controlling statutory audit activity, and ensuring the reliability of companies' financial information. Access to that Spanish body is available at: https://www.icac.gob.es/icac/sobreelicac.

8 The three pillars of ESG data structure the assessment of corporate sustainability through environmental, social and governance criteria. The environmental pillar (E) quantifies the company's ecological impact, measuring critical factors such as its carbon emissions, waste management and consumption of natural resources. The social component (S) examines the organisation's relationship with its human environment, assessing working conditions, workforce diversity and direct impact on the communities in which it operates. Finally, governance (G) analyses the company's internal control structure, ensuring tax transparency, management ethics and regulatory compliance in order to secure responsible long-term management.

the environment within companies' own operations, subsidiaries and chains of activities. Its connection with greenwashing is immediate: many environmental statements refer to the origin, manufacture, raw materials or supply chain of the product. Thus, expressions such as "deforestation-free", "responsible sourcing" or "production respectful of biodiversity" can be sustained only if the company has effective mechanisms for risk identification, prevention, mitigation, documentation and review. Contractual declarations from suppliers are not enough. A chain-sustainability claim properly requires a chain of evidence.

Regulation (EU) 2023/1115 of the European Parliament and of the Council of 31 May 2023 on the making available on the Union market and the export from the Union of certain commodities and products associated with deforestation and forest degradation, and repealing Regulation (EU) No 995/2010, confirms this trend. By linking market access for certain commodities and products to due diligence and traceability obligations, it turns the statement "deforestation-free" into a declaration that presupposes localisation, documentary control and consistency between the declared origin and the physical reality of the chain.

The cross-cutting tendency of all the legislation being adopted is therefore unequivocal: European law is replacing declarative sustainability with traceable sustainability. Transparency ceases to be a soft virtue and becomes legal infrastructure. If the company cannot reconstruct the route followed by the environmental datum, the claim should be regarded as immature, even if it is commercially attractive.

5. Spanish law: from unfair competition to sustainable consumption

In Spain, the treatment of greenwashing has traditionally rested on the Unfair Competition Act, the General Advertising Act and the consolidated text of the General Act for the Defence of Consumers and Users. That framework made it possible to combat false or misleading messages, but it was not specifically designed for the technical complexity of environmental claims.

Directive 2024/825, however, requires a more precise adaptation, particularly in relation to generic statements, sustainability labels, future climate commitments, emission offsets and circularity characteristics.

The Draft Sustainable Consumption Bill[9], approved at first reading by the Council of Ministers on 1 July 2025 and subsequently subject to further processing, was presented as the vehicle for transposing Directive 2024/825 and Directive 2024/1799 on the right to repair[10]. That proposed Spanish legislative text confirms the direction of the Spanish legal order: to strengthen the transparency of commercial practices, sanction misleading environmental claims and connect consumption, repair, circularity and protection against green posturing.

Recent Spanish scholarship has begun to organise this scenario from several perspectives: sustainable consumption and the right to repair, information duties in environmental matters, unfair competition through ecological whitewashing and the transformation of private liability arising from Directive 2024/825. That interpretative construction will be decisive in avoiding two opposing risks: permissiveness towards empty green discourses and overreaction that pushes companies towards greenhushing.

The legal response should not be to silence genuine sustainability, but to require better communication. Fewer absolute adjectives and more verifiable data; less totalising green identity and more delimited scope; fewer future promises and more verifiable plans; fewer ornamental labels and more transparent certifications. Good regulation does not punish sustainability: it punishes its simulacrum.

Internal implications for companies: governance, cross-functional coordination, evidentiary files, and digital traceability of environmental claims

1. Environmental claims as an act of corporate management

As discussed in the previous sections, recent developments in European Union law on consumer protection against unfair commercial practices require a reconsideration of the nature of environmental claims within the firm. Green communication can no longer be understood as a peripheral or merely reputational matter; rather, it must be treated as an expression of the

9 The Draft Sustainable Consumption Bill in Spain is a legislative initiative designed to transform the current consumption model, combat environmental impact and strengthen consumer rights by promoting the circular economy. Its main objective is to transpose key European directives on consumer empowerment and the right to repair, amending existing national legislation such as the General Act for the Defence of Consumers and Users.

10 As at the date of drafting of this article, Directive (EU) 2024/825 on empowering consumers for the green transition through better protection against unfair practices and better information does not yet appear to have been fully transposed into Spanish law, despite the expiry of its transposition deadline on 27 March 2026; its domestic incorporation appears to have been projected, at least in part, through the Draft Sustainable Consumption Bill. Likewise, Directive (EU) 2024/1799 on common rules promoting the repair of goods cannot yet be considered transposed in Spain as at this date, since its maximum transposition deadline extends to 31 July 2026.

company's internal control system. Every message addressed to the market therefore presupposes the existence of a factual basis that is sufficient, verifiable, up to date, and proportionate to the actual scope of the claim being made.

From this standpoint, the environmental claim ceases to be the exclusive product of corporate communications and becomes the outcome of a cross-functional process involving, at a minimum, sustainability, legal, procurement, operations, compliance, quality, and marketing. The central question is no longer merely whether the message is commercially effective, but whether the organisation is capable of reconstructing, ex post, the evidentiary path linking the technical data to the advertising formulation. This shift in analytical focus — from creativity to demonstrability — is one of the most significant transformations brought about by the emerging European anti-greenwashing framework.

Accordingly, any company making environmental claims to consumers should establish an internal approval procedure capable of ensuring, before dissemination, a threefold control test: accuracy, verifiability, and adequacy of the wording to the real extent of the environmental improvement invoked.[11] This does not necessarily require bureaucratising commercial communication; rather, it requires embedding such communication within a framework of organisational diligence. The absence of this ex ante filter increases exposure to unfair competition litigation, administrative sanctions for misleading advertising, and reputational harm that may be difficult to reverse.

2. Strengthening corporate governance systems

2.1. Responsibility of the administrative body

When a company communicates ecological attributes to the market that it cannot adequately substantiate, the deficiency does not remain confined to the advertising sphere. It may instead reveal a deeper failure in the mechanisms of supervision, information, and risk control. In this regard, the governance of greenwashing is directly linked to the quality of the internal compliance system and to the duties of care incumbent upon the administrative body.

The evolution of European sustainability law reinforces this reading. The progressive incorporation of due diligence, risk management, traceability, and transparency obligations into corporate policy contributes to the consolidation of a standard of diligent administration in which the truthfulness of environmental communications is no longer a peripheral issue.[12] Even where the formal scope of some of these obligations does not extend equally to all companies, their interpretive influence is broader: a reasonable director of a company exposed to sustainability messaging should foresee mechanisms capable of preventing inaccurate, ambiguous, absolute, or overstated statements.

It is therefore advisable for the board or equivalent administrative body to approve an internal environmental communication policy setting out substantive principles, standards of linguistic caution, validation procedures, escalation rules, and allocations of responsibility. Senior management should likewise receive periodic information regarding active claims, their documentary support, identified risks, and any incidents or corrective actions. The objective is not merely to prevent legal contingencies, but to incorporate environmental informational integrity into the core of corporate compliance culture.

2.2. Compliance function and greenwashing risk

The compliance function should treat greenwashing as an autonomous regulatory risk rather than as a mere reputational derivative. Its materialisation may lead to administrative sanctions, injunctive actions, damages claims, exclusion from procurement procedures, deterioration of B2B relationships, and erosion of market trust. An especially relevant factor is the multiplication and fragmentation of communication channels. Environmental claims no longer appear only in traditional advertising, but also in labelling, e-commerce interfaces, social media, sustainability reports, investor presentations, contractual documentation, and communications directed to distributors or suppliers.

For that reason, the company's risk map should explicitly identify sources of exposure to greenwashing and associate them with specific controls. This requires periodic review of the consistency between claims made and evidence available, as well as the establishment of internal early-warning channels to detect unsupported statements, methodologically weak assertions, or claims formulated in unduly absolute terms. In many cases, early correction or withdrawal of a problematic claim constitutes the most effective mitigation strategy.

11 See, in particular, the reform introduced by Directive (EU) 2024/825, especially as regards generic environmental claims, claims about future environmental performance, and the use of sustainability labels.

12 European Parliament and Council of the European Union. Directive (EU) 2024/1760 of the European Parliament and of the Council of 13 June 2024 on corporate sustainability due diligence and amending Directive (EU) 2019/1937 and Regulation (EU) 2023/2859. OJ L, 2024/1760, 5 July 2024.

3. Cross-functional coordination: legal, marketing, sustainability, and procurement

3.1. The problem of organisational silos

One of the structural causes of corporate greenwashing lies in the disconnect between the units that produce the data, construct the message, and assess its legal risk. In many organisations, the sustainability function generates indicators and reports, marketing translates those inputs into campaigns, and the legal department intervenes only late in the process or in a limited way. This segmentation favours communicative distortions: a technically correct datum may become a misleading statement if its limits, scope, or methodological conditions are omitted.

The problem is aggravated where the company relies on partial certifications, long-term climate targets, relative reductions, or improvements confined to specific stages of the product life cycle. In such cases, advertising simplification may present as a global attribute what in reality is only a partial, sectoral, temporal, or prospective advantage. The new European regulatory environment is aimed precisely at combating such equivocal generalisations and messages that, while supported by a real factual core, generate in the consumer an environmental impression broader than what can actually be substantiated.

3.2. Coordination mechanisms

The most appropriate organisational response is to institutionalise cross-functional coordination mechanisms. In this regard, it is advisable to establish a permanent or ad hoc environmental communication committee involving sustainability, marketing, legal, compliance, and, where appropriate, procurement, quality, or internal audit. Its role should not be limited to formal validation of wording, but should extend to reviewing the technical support behind the message and the proportionality between the evidence available and the strength of the claim.

It is also particularly useful to implement a documented protocol for the validation of environmental claims. Such a protocol should specify what technical information is required, who provides it, which methodologies, standards, or certifications are considered acceptable, who reviews the limits of the claim, and which authority ultimately approves dissemination. In addition, a substantiation sheet should be prepared for each relevant environmental message, recording the underlying data, source, methodology, material and temporal scope of the statement, its limitations, the date of last update, and the internal person responsible for its custody.

Cross-training between departments also fulfils an essential preventive function. Marketing personnel must understand the semantic and legal limits of expressions such as “sustainable”, “green”, “neutral”, “circular”, or “environmentally friendly”; sustainability teams must anticipate how their indicators may be misunderstood; and legal departments must be familiar with actual market communication practices in order to formulate operational rather than purely abstract criteria.

3.3. Suppliers and value chain management

A significant share of current environmental claims is based on attributes dependent on the supply chain: origin of raw materials, traceability, recycled content, absence of deforestation, indirect emissions, reparability, or production conditions. Internal coordination must therefore extend to procurement functions and supplier relationships. A company cannot validly make certain claims if it lacks contractual, documentary, and technical mechanisms for verifying information received from third parties.

The relevance of this issue is heightened by recent European law on due diligence, traceability, and sustainability in value chains.[13] If a company states, for example, that a product is “deforestation-free”, contains a specific percentage of recycled material, or meets particular environmental sourcing standards, it must be able to substantiate that statement through traceable documentation, control procedures, and, where appropriate, external verification. A commercial message is only as strong as the evidentiary architecture supporting the information received from the supply chain.

4. Building the evidentiary file

4.1. From statement to evidentiary record

The central category for understanding the corporate prevention of greenwashing is the evidentiary file. This should be understood as the ordered set of documents, data, methodologies, validations, and verifications that makes it possible to justify the truthfulness, accuracy, and proportionality of an environmental claim. Its function is essentially preventive: it anticipates the possible burden of proof before consumer authorities, courts, competitors, self-regulatory bodies, or consumer associations.

This file cannot be conceived as a retrospective archive assembled only once a dispute arises. It must exist before the message

13 European Parliament and Council of the European Union. Regulation (EU) 2023/1115 of the European Parliament and of the Council of 31 May 2023 on the making available on the Union market and the export from the Union of certain commodities and products associated with deforestation and forest degradation and repealing Regulation (EU) No 995/2010. OJ L 150, 9 June 2023, 206-247.

is disseminated, remain updated while the claim is active, and be preserved for a reasonable period after its withdrawal. Only in this way can it serve as a genuine instrument of legal defence and internal discipline. Strictly speaking, a company should not communicate what it is not yet in a position to document robustly.

4.2. Minimum content of the file

From the standpoint of sound legal and organisational practice, a robust evidentiary file should include at least the following:

1. Precise identification of the claim, including the exact wording, the medium in which it appears, the date on which use began, and, where relevant, the date of withdrawal, correction, or amendment.
2. Identification of the underlying environmental datum, whether a reduction in emissions, recycled content, water savings, durability, reparability, reuse, or any other communicated attribute.
3. Description of the methodology used, including the technical standard, sectoral benchmark, calculation protocol, or internal procedure employed to generate the data.
4. Substantiation of documentary sources, including reports, certificates, tests, supplier declarations, operational records, or analogous documentation.
5. Definition of the scope of the claim, specifying whether it refers to the product as a whole, one of its components, a specific life-cycle stage, a business line, or the company as a whole.
6. Statement of limits, exclusions, and uncertainties, so as to avoid projecting an environmental impression broader than what is actually substantiated.
7. Record of any external verification, where certification, audit, independent testing, or third-party validation exists.
8. Consistency with corporate sustainability reporting, particularly information reported under the European sustainability reporting framework, in order to avoid contradictions across the company's different communication channels.
9. Revision history, indicating responsible persons, dates, modifications introduced, and reasons for update.

4.3. Document management and traceability

The usefulness of the file also depends on proper document management. It is not enough to accumulate information; accessibility, integrity, retention, legibility, and traceability must also be ensured. The company must be able to locate supporting documentation quickly, demonstrate that it has not been altered, and reconstruct the internal chain through which the message was generated, reviewed, and approved.

In this respect, certain technological solutions — such as time-stamping, qualified electronic signatures, document traceability systems, and interoperable data architectures — may strengthen the robustness of the system. Yet it must be emphasised that no technology can compensate for substantive weakness in the underlying evidentiary support. The legal problem of greenwashing is not, at bottom, a problem of documentary format, but one of material correspondence between what is claimed and what can actually be proven.

5. The Digital Product Passport and the Ecodesign for Sustainable Products Regulation (ESPR)

5.1. The new product-regulation environment

Corporate governance of environmental claims can no longer be analysed in isolation from the regulatory transformation of products under European Union law. In this context, the Ecodesign for Sustainable Products Regulation (ESPR) establishes a general framework for setting ecodesign requirements applicable to products, with a view to improving their durability, reusability, reparability, upgradability, recyclability, resource efficiency, and recycled content, as well as reducing their environmental impacts throughout their life cycle.

5.2. The Digital Product Passport as an infrastructure of verifiability

One of the most significant instruments of this new model is the Digital Product Passport. Conceived as a structured repository of relevant information on the product, its components, materials, sustainability characteristics, reparability, circularity, and, where relevant, end-of-life treatment, the Digital Product Passport is likely to become a central element of the European architecture of product transparency.

From a corporate perspective, the Digital Product Passport should not be understood merely as a future or sector-specific technical compliance obligation, but as an infrastructure of verifiability. Its importance lies in its capacity to provide an objective support base for substantiating matters that have often been communicated through broad or imprecise formulations: material composition, recycled content, origin of certain inputs, spare-part availability, repair instructions, environmental performance, or information relevant to reuse and recycling.

This development requires a reconsideration of the relationship between commercial communication, technical documentation, and data governance. If a company intends to highlight in the market the durability, reparability, material efficiency, or circularity of a product, those attributes must be linked to consistent internal and external data sources, update procedures, and clearly identified responsibilities. Environmental messaging will thus tend to depend less on open-ended narrative constructions and more on verifiable product-information architectures.

5.3. Practical implications for companies

The progressive implementation of the ESPR and the Digital Product Passport will require many companies to adapt their internal systems on at least four levels. First, at the technical-documentary level, product data will need to be structured in a reliable, traceable, and reusable manner across different channels. Second, at the organisational level, closer coordination will be required among design, engineering, sustainability, procurement, IT, legal, and marketing. Third, at the contractual level, companies will need to strengthen the information and traceability obligations imposed on suppliers and sub-suppliers. Fourth, at the communicative level, environmental claims will need to align strictly with the technical information actually available and updated within the product's documentary chain.

For this reason, the Digital Product Passport may become a decisive element in the construction of the evidentiary file for environmental claims. It does not, by itself, replace legal assessment of the lawfulness of a message; but it does facilitate traceability of the attributes invoked, improve coherence between technical evidence and commercial communication, and reduce the room for vague or unsupported statements. In other words, it introduces a logic of structural verifiability that is especially consistent with the tightening of European law against greenwashing.

6. Anticipating litigation and enforcement proceedings

6.1. Conflict scenarios

Any company using environmental claims must anticipate a plurality of conflict scenarios: unfair competition actions brought by competitors; individual or collective consumer claims; consumer-law enforcement proceedings; reputational controversies amplified by media and social networks; and even objections raised in advertising self-regulation contexts. Greenwashing thus operates as a transversal legal risk capable of triggering heterogeneous control mechanisms.

The strengthening of European consumer protection law is likely to intensify this scrutiny[14] As the categories of prohibited or especially suspect environmental practices become clearer, the room for vague, generic, or insufficiently substantiated messaging narrows.

6.2. Defence and mitigation strategy

A defence strategy should not begin with litigation, but with the preventive architecture of the claim itself. Each message should be tested for vulnerabilities: semantic ambiguity, excessive breadth, omission of relevant conditions, reliance on outdated data, improper extrapolation from partial certifications, or use of unjustified absolute language.

It is also advisable to anticipate internally the questions that might be raised by an authority, competitor, or court: what exactly does the message mean, what data support it, what is its scope, which limits ought to be known by the addressee, and to what extent does the commercial wording faithfully reflect the technical support available. The company should likewise maintain internally coherent technical and legal talking points, as well as protocols for immediate withdrawal, correction, or updating whenever a claim becomes inaccurate, obsolete, or disproportionate.

6.3. The role of internal audit

Internal audit may play a leading preventive role, particularly in companies with high media exposure or with market positioning strategies strongly linked to sustainability. Its intervention makes it possible to verify the effectiveness of controls over environmental communication, assess consistency between sustainability reporting, technical documentation, and commercial claims, and identify misalignments between approved policies and actual practice.

Including greenwashing risk within the internal audit plan should not be viewed as defensive overregulation, but as a natural extension of oversight over non-financial risks of growing economic, legal, and reputational significance.

14 European Parliament and Council of the European Union. Directive 2005/29/EC of the European Parliament and of the Council of 11 May 2005 concerning unfair business-to-consumer commercial practices in the internal market. OJ L 149, 11 June 2005, 22-39; European Parliament and Council of the European Union, Directive (EU) 2024/825.

7. Towards a corporate culture of environmental verifiability

Ultimately, the requirements of governance, cross-functional coordination, evidentiary record-building, and digital product traceability should be understood as structural elements of a corporate culture of environmental verifiability. The purpose of European law is not to discourage communication of genuine sustainability progress, but to prevent environmental language from becoming detached from its empirical basis and turning into an instrument for distorting consumer economic behaviour.

A legally prudent company is not one that remains silent, but one that communicates with precision, delimits the scope of its statements, acknowledges their limits, documents their factual premises, and updates its messaging as its environmental performance and the applicable regulatory framework evolve. In this sense, verifiability is not an external burden added to business activity, but a condition of legitimacy for green communication in the contemporary market.

Systems architecture and data infrastructure for environmental verifiability

From the perspective of computer engineering and systems architecture, the shift from declarative sustainability to traceable sustainability requires replacing monolithic, siloed information systems with interoperable service-oriented or microservices architectures. The regulatory risk of greenwashing cannot be mitigated with patches to the presentation layer or to marketing-facing user interfaces; it requires a re-engineering of the backend and of the extract, transform and load (ETL) data flows.

For an environmental claim to cease being a unit of legal risk and instead become a computable, demonstrable hypothesis, organisations must implement unified data repositories, in which information from physical sensors on the shop floor, transactional records from enterprise management systems, and supplier declarations is consolidated through automated data pipelines. If the technological infrastructure suffers fragmentation or inconsistency across its databases, any consolidation algorithm will inherit that defect (the well-known computing principle that low-quality data produces low-quality conclusions), unintentionally generating inaccurate reports that breach legal transparency requirements.

The seven practices set out below should not be read as a catalogue of infallible solutions, but as illustrations of a single principle: each of them reduces a specific type of compliance risk, but none eliminates it entirely, and all of them require governance — supported by frameworks such as ITIL v4[15] and PRINCE2[16] — that decides when the cost of implementation is justified by the legal risk it mitigates.

1. Service lifecycle management under ITIL v4: the Sustainability Management Practice and the Service Value Chain

The technological mitigation of greenwashing does not depend solely on isolated software tools, but on the structured management of IT services. The ITIL v4 framework offers, in this regard, a relevant methodological approach through its Service Value System (SVS) and, in particular, through the incorporation of sustainability into the four dimensions of service management: organisations and people; information and technology; partners and suppliers; and value streams and processes.

Under ITIL v4 guidelines, environmental impact data can be managed as just another critical IT service.[17] The "Design and Transition" activity of the Service Value Chain should ensure that any new software or infrastructure development includes specific telemetry to measure the carbon footprint associated with data processing and storage, before that development reaches production. Likewise, the practice of Service Configuration Management — underpinned by a configuration management database (CMDB) — can be extended so that each configuration item, whether a physical server, a virtual container or an integration with an external provider, traceably records its energy-efficiency metadata.

It is worth qualifying, however, the real scope of this integration. ITIL v4 was not originally designed with environmental sustainability as its central object, and adapting it to this purpose requires an interpretive and mapping effort that the framework does not resolve on its own. Integrating Service Level Management with ESG compliance criteria allows continuous monitoring of whether the infrastructure's actual capabilities support the emissions-reduction commitments the company communicates externally, but that monitoring is only as reliable as the indicators chosen for measurement: a system that measures servers' electricity consumption, for example, does not on its own capture the origin — renewable or not — of that electricity, unless it is supplemented with contractual data from the energy provider. The promise of "zero information gaps between operational reality and commercial discourse" should therefore be understood as a design goal to strive towards, not as a result guaranteed by the mere adoption of the framework.

15 Agutter, Claire. *ITIL 4 High-Velocity IT (HVIT): Your Companion to the ITIL 4 Managing Professional HVIT Certification*. IT Governance Publishing, 2021.

16 AXELOS. *Managing Successful Projects with PRINCE2*. 6th ed. TSO (The Stationery Office), 2017.

17 AXELOS. *ITIL Foundation: ITIL 4 Edition*. TSO (The Stationery Office), 2019.

2. Governance of the evidentiary project through the PRINCE2 methodology

Building, deploying and maintaining a robust digital evidentiary file requires a project-management discipline focused on deliverable control. The PRINCE2 methodology (Projects in Controlled Environments) offers a useful governance framework to reduce — not eliminate — technical deviations and loss of analytical detail in the process.[18]

Through its "Continued Business Justification" principle, PRINCE2 requires that the viability of the environmental traceability project remain aligned with the company's legal compliance risk map, so that the project is reassessed if that risk changes. By structuring the project into defined stages through the "Directing a Project" process, the Project Board — where the legal, technology and sustainability areas should converge — can exercise control over time, cost and, above all, Quality tolerances. The "Quality" theme in PRINCE2 translates, in this context, into the definition of specific data acceptance criteria: no software module responsible for calculating a sustainability indicator should move from a development stage to a production stage without the formal sign-off of the legal officer, documenting compliance with the project's quality management strategy. This division into technical stages favours the creation of audit trails that are useful against greenhushing or greenwashing contingencies, although it should be stressed that PRINCE2 manages the risk of the implementation project — that it be executed as planned — but does not replace a substantive legal judgment as to whether the environmental claim the system ultimately allows to be sustained is, in itself, correct.

3. Preventive automation of compliance through DevOps, agile methodologies and natural language processing

The integration of these governance frameworks into the software development lifecycle can be structured by emulating agile methodologies — such as Scrum or Kanban — and DevOps practices, under the concept of Compliance-as-Code.[19] During the development sprints of e-commerce platforms or content management systems, regulatory requirements derived from rules such as Directive (EU) 2024/825 can be translated into user stories and technical acceptance criteria within the product backlog, bringing forward into ITIL v4's "Design and Transition" stage the control that would otherwise only be applied just before final publication.

To automate this ex ante control, continuous integration and deployment pipelines can be deployed[20] incorporating natural language processing models[21] capable of analysing the text, metadata and labels of marketing campaigns. If the model detects generic, absolute expressions — such as "100% eco-friendly" or "climate neutral" — without a configuration file linking the claim to a valid certification, the pipeline can block the automatic deployment, preventing the commercial message from being published without the required documentary basis.

This automation has limits that should not be understated. Natural language processing models are reasonably effective at detecting well-known, stereotyped formulas, but they generate both false negatives — equally problematic claims phrased more subtly, or written in a language for which the model is not well trained — and false positives, which can block legitimate content and create operational friction. A pipeline of this kind reduces the volume of manual review required; it does not replace it. How much to trust the automatic filter as against the review of a compliance officer is, again, a governance decision — and a Quality acceptance criterion in PRINCE2 terms — not an intrinsic property of the technology.

4. Traceability through blockchain, smart contracts and cryptographic patterns

When the legal framework requires building a robust evidentiary file, distributed ledger technology and smart contracts offer a technical means of reinforcing the immutability and non-repudiation of digital evidence, against the risk that documentary evidence stored on conventional servers might be altered retroactively.[22] Each time a supply-chain provider records an environmental milestone — the volume of water treated or the renewable energy consumed in a production batch — the system can generate a unique hash of that event and record it in a block on the network. Smart contracts, acting as logical controllers in the backend, can automatically assess whether the data entered by the supplier meets the validation rules of ESG standards, and reject the transaction — preventing the tokenisation of the green attribute — if it does not.

18 Hinde, David. *PRINCE2 Study Guide: 2017 Update*. 2nd ed. John Wiley & Sons, 2018.

19 Füller, K., and M. Hummel. "Compliance-as-Code: Automating Regulatory Compliance in Agile Software Development." *Journal of Software: Evolution and Process* 34, no. 8 (2022): e2461. doi:10.1002/smr.2461.

20 Humble, Jez, and David Farley. *Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation*. Addison-Wesley Professional, 2010.

21 Bird, Steven, Ewan Klein, and Edward Loper. *Natural Language Processing with Python: Analyzing Text with the Natural Language Toolkit*. O'Reilly Media, 2009.

22 Saberi, Sara, Mahtab Kouhizadeh, Joseph Sarkis, and Lejia Shen. "Blockchain Technology and Its Relationships to Sustainable Supply Chain Management." *International Journal of Production Research* 57, no. 7 (2019): 2117-2135. doi:10.1080/00207543.2018.1533261.

This solution, however, displaces the trust problem rather than eliminating it: the immutability of the record guarantees that a piece of data will not be altered once recorded, but it does not guarantee that the data was correct at the time it was recorded. If the sensor measuring the volume of treated water is poorly calibrated, or if the supplier manually enters an inaccurate figure, the blockchain will record that inaccuracy with the same immutability as if it were correct — what is sometimes described as the "garbage in, gospel out" problem.[23] The evidentiary value of this architecture therefore depends on its being combined with the source-data quality controls described in the preceding sections, and it should not be presented as a substitute for them.

5. Cloud computing, satellite observation and the Digital Product Passport

To respond to highly technically demanding regulations, such as Regulation (EU) 2023/1115 on deforestation-free products, organisations' IT systems can be integrated with high-performance cloud computing platforms. Verification of raw materials can rely on the processing of geospatial data and time series of satellite imagery, using computer-vision algorithms trained to detect changes in land use at the geographic coordinates recorded in procurement databases.

This telemetry can be exposed through an API architecture supporting the Digital Product Passport, conceived as a web service that allows a QR code printed on the product to query the company's servers and obtain a structured response with the product's composition, its reparability index and the history of its carbon footprint. It should be stressed that the reliability of computer-vision algorithms for detecting deforestation varies considerably depending on the resolution of the available imagery, the satellite's revisit frequency and cloud cover in the area, such that an alert — or the absence of one — should be interpreted as a lead that guides the investigation, not as conclusive proof on its own. The Digital Product Passport turns the evidentiary file into an auditable, dynamic object, but its legal robustness likewise depends on the data feeding that API having passed the quality and governance controls described in sections 1 to 3.

6. Cascading validation architecture: three-phase automation through computer vision, drones and remote sensing

To optimise the human resources of regulatory bodies or internal audit departments, and to reduce the number of unnecessary physical inspections, IT infrastructure can implement a filtering and validation strategy structured in a three-phase cascade, in which each phase acts as a gateway condition for the next:

- **Phase 1: passive validation based on documentary metadata.** When uploading a sustainability report, the system can require the submission of photographic evidence of the facilities, processed through a script that validates its EXIF metadata (GPS coordinates, timestamp, device signature). If the metadata does not match the declared location, the system can automatically reject the report, without any human involvement in that first screening.
- **Phase 2: dynamic verification using drones and computer vision.** Once the first filter has been passed, images can be captured at the declared coordinates using unmanned aerial vehicles, processed with convolutional neural networks trained to recognise industrial infrastructure.[24] If the algorithm corroborates the existence of the declared facility, the system can issue a pre-approval; if it detects a severe discrepancy — for example, vacant land instead of the declared plant — it can deny the report immediately.
- **Phase 3: physical audit by field technicians.** The human visit is reserved for cases in which the previous phases do not reach a predefined reliability threshold, or for verifications — such as chemical sampling or auditing sensor firmware — that no visual sensor can perform on its own.

This model significantly reduces the cost of verification, but it is important to be precise about what it actually guarantees. The convolutional neural networks used in Phase 2 have known error rates — both false positives and false negatives — that depend on the quality of the training and the conditions under which the images were taken; a reliability threshold of 95%, for example, necessarily implies that, on average, one in every twenty automatic validations could be incorrect. Setting that threshold is, again, a risk-governance decision — not a technical guarantee — that should be documented and periodically reviewed, rather than presented as a fixed property of the system.

7. Integration of the visual audit pipeline into change and release management

From a PRINCE2 perspective, this three-phase pipeline maps onto risk management and quality control: automatic rejection alerts in Phase 1 or Phase 2 can be treated as a "Management by Exception" mechanism, such that, if the software denies a

23 Schmidt, Christoph G., and Stephan M. Wagner. "Blockchain and Supply Chain Relations: A Transaction Cost Theory Perspective." *Journal of Purchasing and Supply Management* 25, no. 4 (2019): 100552. doi:10.1016/j.pursup.2019.100552.

24 Gorelick, Noel, Matt Hancher, Mike Dixon, Simon Ilyushchenko, David Thau, and Rebecca Moore. "Google Earth Engine: Planetary-Scale Geospatial Analysis for Everyone." *Remote Sensing of Environment* 202 (2017): 18-27. doi:10.1016/j.rse.2017.06.031.

report, an exception is automatically raised to the Project Board, preventing the certification project from consuming additional budget on physical inspections that the available evidence has already ruled out.
From an ITIL v4 standpoint, this three-phase flow can be understood as a way of automating the Release and Deployment Management practice: the approval of an environmental claim or of a Digital Product Passport is treated, computationally, as the passage of a software package from a test environment to the real production environment — the market — and the documentary and drone-based recognition phases operate as automated integration tests prior to that release.
This combined reading, however, calls for a final caveat that must be made explicit: none of the practices described in this section, whether individually or in combination, constitutes an infallible system. What these service- and project-management frameworks provide is not a guarantee of compliance, but a discipline of continuous improvement and risk management: they document what was verified, by what method, with what level of confidence, and under whose responsibility. That documentation is precisely what distinguishes an organisation that acted with reasonable technological diligence from one that simply trusted that its infrastructure was sufficient without ever having checked. It is that standard of reasonable diligence — not the promise of perfect verification — that a court or regulator will foreseeably weigh when examining whether a sustainability claim was adequately supported.

Conclusions

The first conclusion of the current regulatory framework is unequivocal: sustainability can no longer operate as an aesthetic resource of the market. A company that communicates an environmental advantage enters a legal space of evidence. Directive 2024/825 sets the prohibitive core; the Green Claims Directive, although uncertain, anticipates the requirement of scientific substantiation; the CSRD turns reporting into an infrastructure of verifiable data; the CSDDD and the Deforestation Regulation extend the requirement to value chains; and Spanish law is moving towards a specific reception of this paradigm in terms of sustainable consumption.
The second conclusion is methodological. Greenwashing should not be analysed solely as advertising falsehood, but as a traceability deficit between what the company is, what it does, what it measures, what it reports and what it communicates. Unlawfulness may arise in any of those fractures. A company may have genuine environmental initiatives and nevertheless engage in greenwashing if it communicates them in an exaggerated, global, omissive or methodologically opaque manner.
The third conclusion is linked to corporate compliance. If every environmental claim is a hypothesis that must be capable of proof, companies need internal approval procedures, evidential files, risk matrices, coordination between legal, sustainability, marketing and procurement functions, and updating mechanisms. Undocumented sustainability is legally fragile; poorly documented sustainability is litigious; sustainability that is verified and communicated with precision may become a legitimate competitive advantage.
In short, European law has not declared war on corporate sustainability. It has declared war on its simulacrum. The company of the next regulatory cycle will not be credible because it says that it is green, but because it can demonstrate, with data, limits and method, which part of its activity genuinely deserves that description.
The fourth conclusion concerns corporate governance. Environmental claims can no longer be treated as isolated marketing statements, but must be understood as decisions attributable to the company's governance and control structure. Their legal robustness depends not only on the wording of the final message, but on the existence of internal processes capable of validating, documenting and supervising the claim before it reaches the market.
From this perspective, the prevention of greenwashing becomes a matter of organisational design. It requires effective oversight by the management body, the integration of greenwashing into the compliance risk map, genuine coordination between sustainability, marketing and legal functions, and the prior construction of a robust and traceable evidentiary record. These mechanisms perform a dual function: they reduce exposure to sanctions, litigation and reputational harm, while also improving the reliability of the environmental information made available to the market.
The fifth conclusion is of a purely architectural and systems-engineering order. The regulatory shift towards traceable, immutable sustainability is technically unworkable if the classic fragmentation of relational databases and isolated monolithic systems is maintained. Mitigating the computing risk of generating erroneous metrics (Garbage In, Garbage Out) requires the convergence of federated data infrastructures (data lakes), process automation (Compliance-as-Code) and immutable decentralised ledgers (blockchain and smart contracts). Technology thus shows that an environmental claim ceases to be a diffuse legal risk once it becomes a computable hypothesis in the organisation's backend, where business rules automatically and physically prevent

the release or deployment of any advertising claim that is not cryptographically linked to a valid certification ID or to a traced product batch.

The sixth conclusion concerns the automation of operational and physical control through sensing and remote sensing. The robustness of the modern evidentiary file requires decoupling evidence from mere documentary declarations or manipulable static photographs. By implementing cascading asynchronous validation architectures structured into automated phases — where the analysis of photographic EXIF metadata acts as the first passive filter, and video processing using computer vision and convolutional neural networks (CNNs) on drone (UAV) flights or satellite imagery constitutes the dynamic verification — IT equips organisations and regulators with an operational safeguard intended to be highly reliable. This funnel-based algorithmic model not only radically optimises operating costs by avoiding unnecessary deployment of field inspectors to facilities with severe discrepancies, but also gives concrete form to the Digital Product Passport (DPP) as an interoperable API. Ultimately, the physical product's digital twin replaces the corporate narrative with auditable telemetry, turning the utopia of environmental verification into a scalable, transparent and legally defensible software solution.

Bibliographical and legal references

Agutter, Claire. *ITIL 4 High-Velocity IT (HVIT): Your Companion to the ITIL 4 Managing Professional HVIT Certification*. IT Governance Publishing, 2021.

AXELOS. *Managing Successful Projects with PRINCE2*. 6th ed. TSO (The Stationery Office), 2017.

———. *ITIL Foundation: ITIL 4 Edition*. TSO (The Stationery Office), 2019.

Bird, Steven, Ewan Klein, and Edward Loper. *Natural Language Processing with Python: Analyzing Text with the Natural Language Toolkit*. O'Reilly Media, 2009.

European Commission. "Consumer Protection: Enabling Sustainable Choices and Ending Greenwashing." Press release IP/23/1692, 22 March 2023. https://ec.europa.eu/commission/presscorner/detail/en/ip_23_1692.

———. Proposal for a Directive of the European Parliament and of the Council on Substantiation and Communication of Explicit Environmental Claims (Green Claims Directive). COM(2023) 166 final, 22 March 2023. https://environment.ec.europa.eu/publications/proposal-directive-substantiation-and-communication-explicit-environmental-claims_en.

———. "Corporate Sustainability Reporting." Accessed 13 May 2026. https://finance.ec.europa.eu/financial-markets/company-reporting-and-auditing/company-reporting/corporate-sustainability-reporting_en.

———. "Green Claims." Accessed 13 May 2026. https://environment.ec.europa.eu/topics/circular-economy-topics/green-claims_en.

European Parliament. "Legislative Train Schedule: Substantiating and Communicating Green Claims." 2026. Accessed 13 May 2026. https://www.europarl.europa.eu/legislative-train/theme-a-european-green-deal/file-substantiating-green-claims.

European Parliament and Council of the European Union. Directive 2005/29/EC of the European Parliament and of the Council of 11 May 2005 concerning unfair business-to-consumer commercial practices in the internal market. OJ L 149, 11 June 2005, 22-39.

———. Directive (EU) 2022/2464 of the European Parliament and of the Council of 14 December 2022 amending Regulation (EU) No 537/2014, Directive 2004/109/EC, Directive 2006/43/EC and Directive 2013/34/EU, as regards corporate sustainability reporting. OJ L 322, 16 December 2022, 15-80.

———. Regulation (EU) 2023/1115 of the European Parliament and of the Council of 31 May 2023 on the making available on the Union market and the export from the Union of certain commodities and products associated with deforestation and forest degradation and repealing Regulation (EU) No 995/2010. OJ L 150, 9 June 2023, 206-247.

———. Directive (EU) 2024/825 of the European Parliament and of the Council of 28 February 2024 amending Directives 2005/29/EC and 2011/83/EU as regards empowering consumers for the green transition through better protection against unfair practices and through better information. OJ L, 2024/825, 6 March 2024.

———. Directive (EU) 2024/1760 of the European Parliament and of the Council of 13 June 2024 on corporate sustainability due diligence and amending Directive (EU) 2019/1937 and Regulation (EU) 2023/2859. OJ L, 2024/1760, 5 July 2024.

———. Regulation (EU) 2024/1781 of the European Parliament and of the Council of 13 June 2024 establishing a framework for the setting of ecodesign requirements for sustainable products, amending Directive (EU) 2020/1828 and Regulation (EU) 2023/1542 and repealing Directive 2009/125/EC. OJ L, 2024/1781, 28 June 2024. http://data.europa.eu/eli/reg/2024/1781/oj.

———. Directive (EU) 2024/1799 of the European Parliament and of the Council of 13 June 2024 on common rules promoting the repair of goods and amending Regulation (EU) 2017/2394 and Directives (EU) 2019/771 and (EU) 2020/1828. OJ L, 2024/1799, 10 July 2024.

Füller, K., and M. Hummel. "Compliance-as-Code: Automating Regulatory Compliance in Agile Software Development." *Journal of Software: Evolution and Process* 34, no. 8 (2022): e2461. doi:10.1002/smr.2461.

Gorelick, Noel, Matt Hancher, Mike Dixon, Simon Ilyushchenko, David Thau, and Rebecca Moore. “Google Earth Engine: Planetary-Scale Geospatial Analysis for Everyone.” *Remote Sensing of Environment* 202 (2017): 18-27. doi:10.1016/j.rse.2017.06.031.

Government of Spain, Ministry of Social Rights, Consumer Affairs and 2030 Agenda. Draft Sustainable Consumption Bill (Anteproyecto de Ley de Consumo Sostenible). Approved at first reading by the Council of Ministers, 1 July 2025.

Hinde, David. *PRINCE2 Study Guide: 2017 Update*. 2nd ed. John Wiley & Sons, 2018.

Humble, Jez, and David Farley. *Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation*. Addison-Wesley Professional, 2010.

Institute of Accounting and Auditing (ICAC). “Verification of Sustainability Information.” Accessed 13 May 2026. https://www.icac.gob.es/sostenibilidad/verificacion.

Saberi, Sara, Mahtab Kouhizadeh, Joseph Sarkis, and Lejia Shen. “Blockchain Technology and Its Relationships to Sustainable Supply Chain Management.” *International Journal of Production Research* 57, no. 7 (2019): 2117-2135. doi:10.1080/00207543.2018.1533261.

Schmidt, Christoph G., and Stephan M. Wagner. “Blockchain and Supply Chain Relations: A Transaction Cost Theory Perspective.” *Journal of Purchasing and Supply Management* 25, no. 4 (2019): 100552. doi:10.1016/j.pursup.2019.100552.